SURFACE FEATURES OF STRIGA SEEDS (SCROPHULARIACEÆ)

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ABSTRACT : Seeds of nine species of the root parasitic genus *Striga* were examined using the scanning electron microscope. All species have aereolate surfaces with prominent ridges. These primary ridges are always ornamented with bilobed protuberances near the crest of the ridge. Less prominent secondary ridges run at varying angles between primary ridges. Secondary ridges may lack ornamentation. There appears to be little correlation between surface features and host specific morphotypes although surface features may be of some taxonomic value in certain species complexes.

RÉSUMÉ : L'étude des graines de 9 espèces du genre *Striga* (parasite sur racines) a été faite en microscopie électronique à balayage. Toutes les espèces ont des surfaces aréolées à côtes saillantes. Ces côtes primaires sont toujours ornées de protuberances bilobées près de leur crête. Des côtes secondaires, moins proéminentes, font des angles variés entre les côtes primaires. Ces côtes secondaires peuvent être dépourvues d'ornementation. Peu de corrélations entre les caractères de surface et les morphotypes spécifiques des hôtes ont été mises en évidence; cependant, les caractères de surface ont un intérêt taxonomique dans certains groupes d'espèces complexes.

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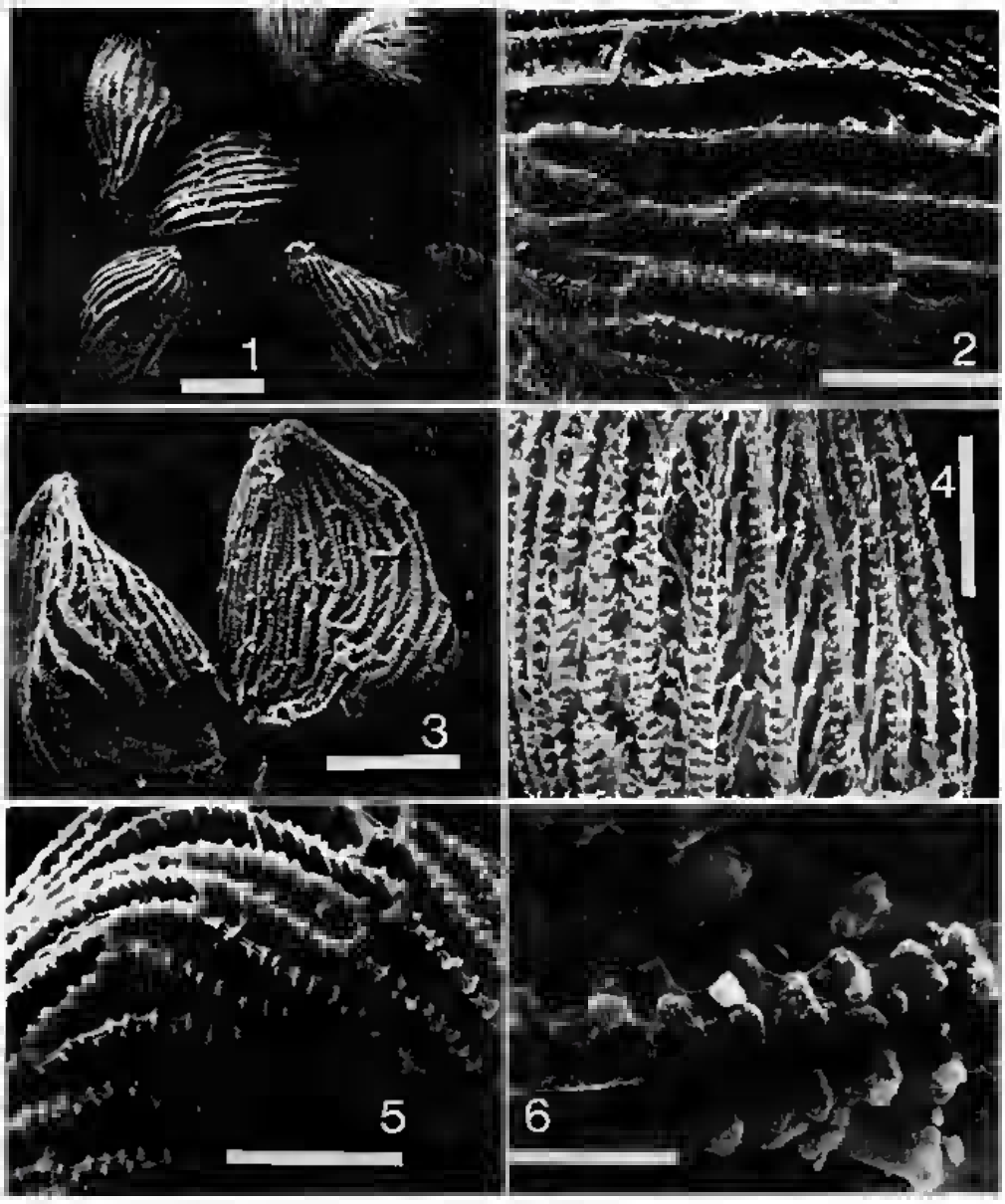
INTRODUCTION

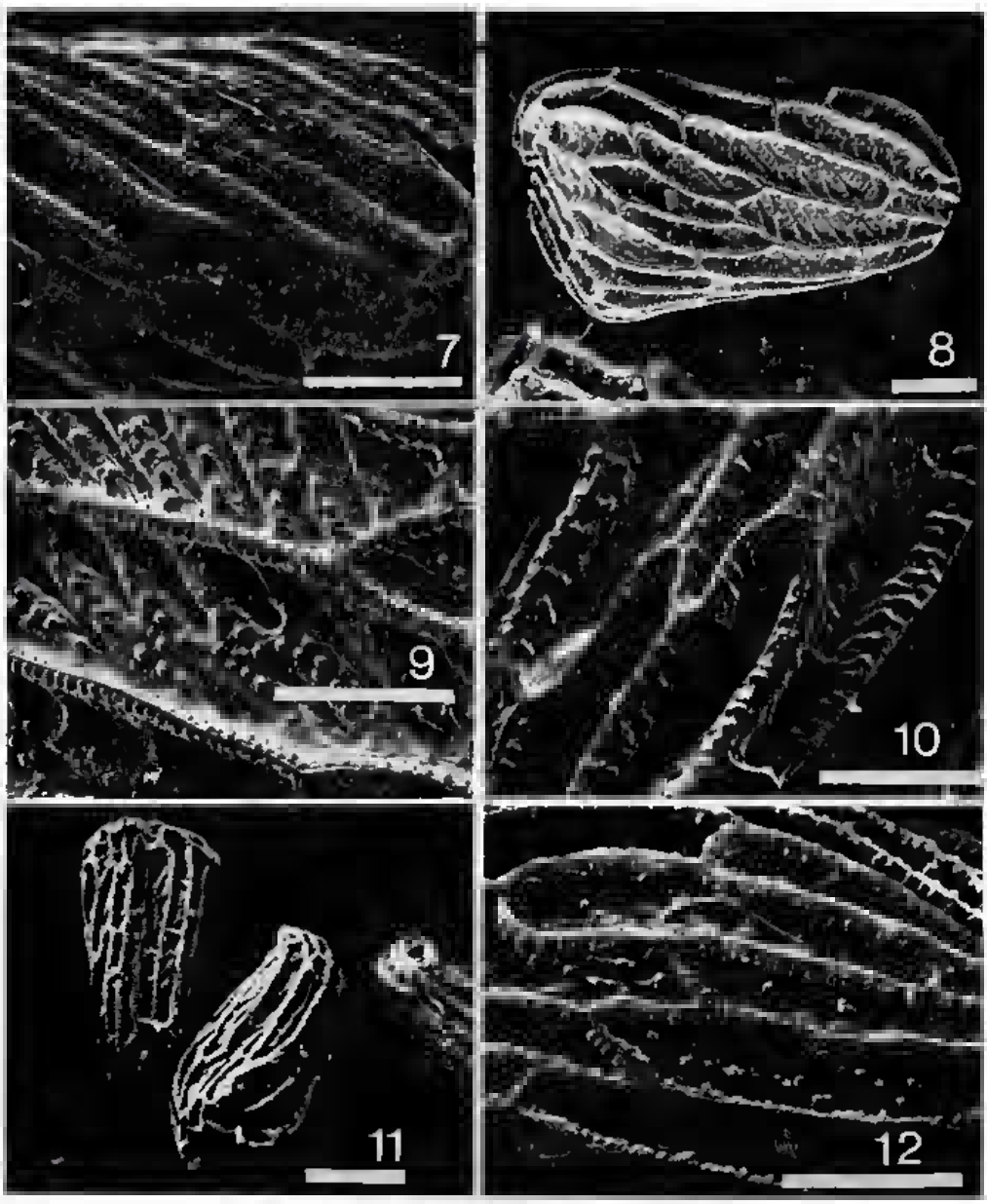
Striga is an old world and Australian genus of about 25 species. All are obligate root parasites and include several species that are serious pathogens of food crops. Of these, *S. hermonthica*, *S. asiatica* and *S. gesnerioides* are the most important, although other species have also been implicated in crop losses.

There is considerable variation in morphology, size, flower colour and host specificity in these three species. *Striga asiatica* and *S. gesnerioides* are especially variable and have distinct morphotypes apparently associated with geographical distribution and/or host preference (MUSSELMAN & *al.*, 1979). One objective of the present study was to determine if the seeds of these morphotypes possessed distinct surface characteristics; such information could be useful in predicting host preference for an introduced strain.

A second objective was to produce illustrations of seeds. Previous studies on surface features of *Striga* are restricted to those of MUSSELMAN & MANN (1976) and VISSER & WENTZEL (1980). *Striga* seeds are very small and are, therefore, ideal subjects for an SEM study.



Pl. 1. — **Striga asiatica** : **1** (76-5), note the poorly developed secondary ridges compared with Fig. 4; scale = 100 μm; **2** (78-3), note the size of the protuberances of the primary ridges compared with other strains (Figs. 4-6); scale = 50 μm; **3** (79-1), general view of seeds; a faint secondary ridge is noticeable running at acute angles to the primary ridges; scale = 100 μm; **4** (77-5), in this strain of this species the secondary ridge is more pronounced; scale = 50 μm; **5** (78-4), the protuberances on the seed are very narrow; scale = 50 μm; **6** (79-1), close-up of protuberances; scale = 10 μm.



Pl. 2. — **Striga densiflora** (74-1): **7,** detail of surface; in this species the regions between the ridges are only sparsely ornamented; scale = 50 μm. — **Striga euphrasioides** (67-1): **8,** this species has very distinct surface features, especially of the secondary ridges; scale = 100 μm; **9,** detail of the secondary ridges showing the conspicuous protuberances; scale = 50 μm. — **Striga forbesii** (78-3): **10,** the ornamentation of the primary ridges is obscure with short, blunt protuberances; scale = 50 μm. — **Striga gesnerioides** (79-1): **11,** general view; scale = 100 μm; **12,** note scattered protuberances on secondary ridges; scale = 50 μm.

METHODS AND MATERIALS

Seeds used were from the parasitic seed collection of the tropical weeds laboratory of the Weed Research Organization (WRO). Herbarium vouchers for most samples are filed in the tropical weeds herbarium at WRO. Table 1 lists seeds examined in this study.

Untreated seeds were mounted with double sided cellophane tape, gold coated in a Polaron E500 diode sputtering system and examined with a Cambridge Stereoscan 150 microscope.

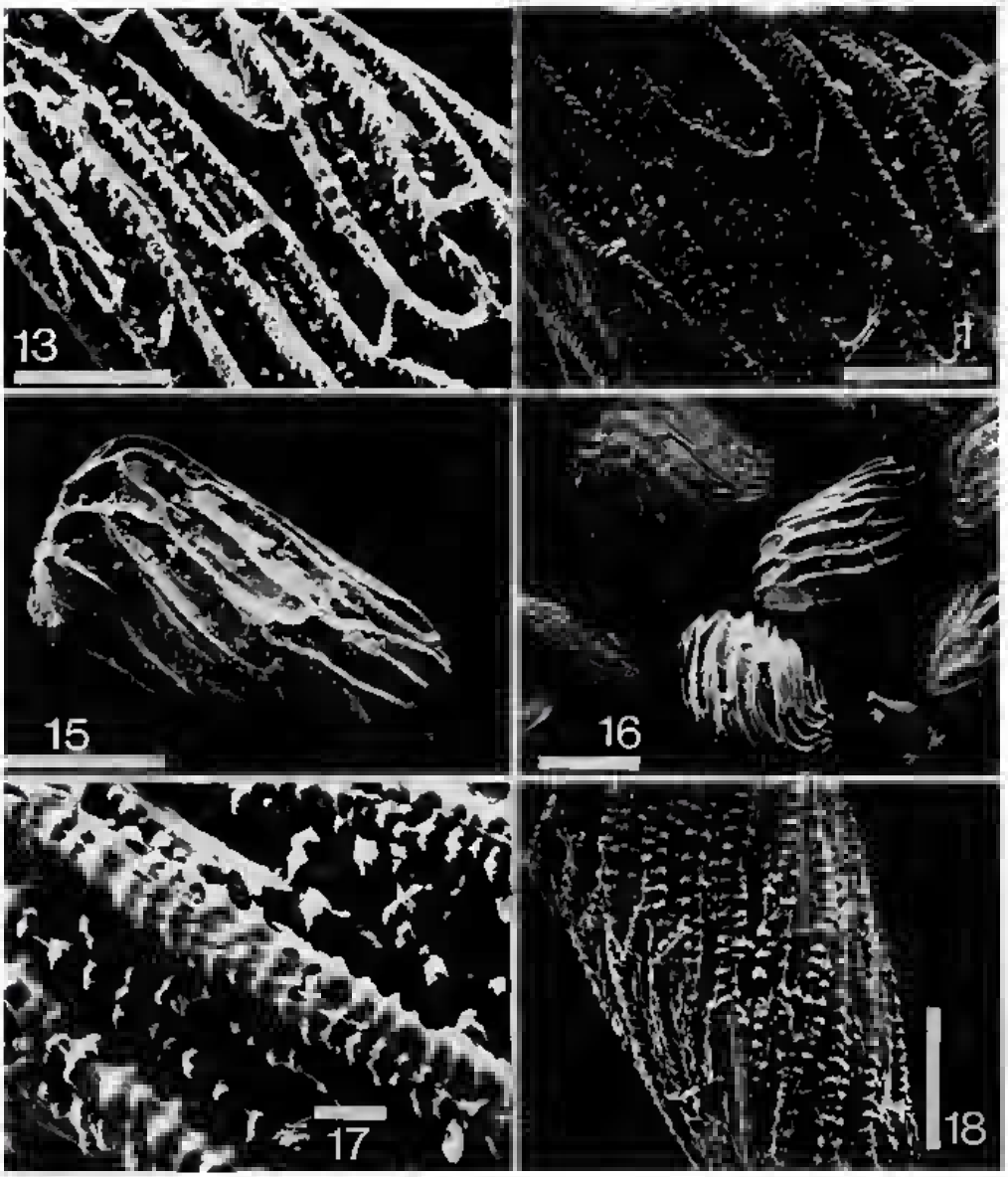
RESULT AND DISCUSSION

Results are presented in figures 1-18. The shape of the seeds is in all cases variable. The length of the seeds is mainly 0.20-0.35 mm but *S. eurasioides* is longer, i.e. 0.50. The surface of the seeds of each *Striga* species has a double system of ridges. The most prominent, here termed the primary ridge, are apparently produced by outgrowths of cells (MUSSELMAN & MANN, 1976). These often spiral around the seed although the angle of the individual ridges is quite variable even in the same seed sample. A less prominent set of ridges, secondary ridges, may either run parallel with the primary ridges (figs. 2-5, 7, 13-18) or at a distinct angle to the primary ridges (figs. 2-4, 8, 9).

The primary ridges are always ornamented. The basic pattern is two protuberances on each side of the crest of the ridge. Each protuberance has two lobes, evident only under high magnification (figs. 6, 10, 12, 14, 17). The secondary ridges may also be ornamented but with protuberances of different morphology from those of the primary ridges. This is well illustrated in *Striga euphrasioides*, where the primary ridges have very uniform protuberances, while those of the secondary ridges are more uneven in size and spacing (fig. 9). The surface not covered by ridges is only sparsely ornamented, if at all (figs. 4, 10, 12, 15).

Only in *Striga asiatica* was it possible to discern differences in seed surface features of different geographical origin. In general, seeds from Asia have more highly ornamented seeds. Such seeds have more protuberances, and distinctly angled secondary ridges (cf. figs. 3 and 6 from Asia with figs. 1 and 5 from the United States and South Africa). This finding is supported by other work on the American strain (MUSSELMAN & MANN, 1976) and on the South African strain (VISSER & WENTZEL, 1980). It is usually assumed that *S. asiatica*, discovered in the Carolinas in the United States in the 1950s, originated from South Africa.

Unlike *S. asiatica*, it is not possible to distinguish the various morphotypes/geographical strains of the other two wide-ranging species (*S. gesnerioides* and *S. hermonthica*) on the basis of seed surface features. Strains of *S. hermonthica* from sorghum (*Sorghum vulgare*) (fig. 15) and from millet (*Pennisetum americanum*) (fig. 16) are indistinguishable on the basis of seed coat characteristics both having variable amounts of ornamentation. e.g. figures 16 and 17.



Pl. 3. — **Striga passargei** (79-1): **13,** in this species the protuberances are obtuse and short; scale = 50 µm. — **Striga aspera (77-1): 14,** large protuberances are evident on the secondary ridges and spaces between ridges. These protuberances are larger than those on the primary ridges; scale = 50 µm. — **Striga hermonthica** (71-11): **15,** this illustrates one extreme of ornamentation; in this strain, the ridges have only small, short protuberances; scale = 100 µm; **16** (77-25), general aspect of seeds; scale = 100 µm; **17** (77-7), primary and secondary ridges and protuberances; scale = 10 µm. — **Striga parviflora** (79-1): **18,** note similarity to *S. asiatica* (77-7); scale = 50 µm.

TABLE 1 : SPECIES OF *STRIGA*, LOCATION AND HOSTS

SPECIES	ORIGIN	HOST	WRO SEED NO
Striga aspera (Willd.) Benth.	Sintiou-Maleme, Senegal	(wild grasses)	77-1
Striga asiatica (L.) Kuntze	Bogor, Indonesia	(wild grasses)	79-3
«	Rajasthan, India	*Pennisetum*	77-3
«	Mtwara, Tanzania	*Sorghum*	78-2
«	Bronkhorstspruit, South Africa	*Zea*	78-4
«	Koral, Thailand	(not known)	78-3
«	Pantancheru, India	*Sorghum*	76-3
«	North Carolina, USA	*Zea*	76-5
«	Akola, India	*Sorghum*	76-2
«	Karnataka, India	*Sorghum*	77-5
«	Sumatra, Indonesia	(wild grasses)	79-1
«	Parbhani, India	*Sorghum*	73-1
Striga densiflora Benth.	Gujarat, India	(not recorded)	74-1
Striga euphrasioides Benth.	Lucknow, India	(not recorded)	67-1
Striga forbesii Benth.	Zaria, Nigeria	(not recorded)	78-3
Striga gesnerioides (Willd.) Watke	South Africa	*Nicotiana*	78-1
«	Bolgatanga, Ghana	*Tephrosia*	77-8
«	Maradi, Niger	*Jacquemontia*	77-6
«	South Africa	*Monsonia*	77-5
«	Kambouinse, Upper Volta	*Vigna*	77-1
«	Maradi, Niger	*Vigna*	77-4
«	Florida, USA	*Indigofera*	79-1
Striga hermonthica (Del.) Benth.	Sapu, Gambia	*Sorghum*	79-5
«	Samaru, Nigeria	*Sorghum*	77-38
«	Maradi, Niger	*Pennisetum*	77-4
«	Kordofan, Sudan	*Pennisetum*	74-1
«	Abu Naama, Sudan	*Sorghum*	77-25
«	Thiou, Upper Volta	*Pennisetum*	77-7
Striga passargei Benth.	Zaria, Nigeria	(wild grasses)	79-1
Striga parviflora Benth.	Queensland, Australia	*Schizachyrium*	79-1

Surface features of seeds may have taxonomic value. *Striga euphrasioides* seeds are distinct among those examined. This correlates well with the distinct morphology of this species. Likewise, *Striga forbesii* (fig. 10) has a distinct ridge ornamentation where the protuberances are unequal in spacing and size. Furthermore, this species has distinctive leaves and prefers much wetter habitats than most species.

Surface features may also be of value in the study of species complexes such as the *S. hermonthica*/*S. aspera*/*S. passargei* group. *Striga aspera* closely resembles *S. hermonthica* in overall morphology and is also sympatric with it in distribution (MUSSELMAN & *al.*, 1979). The seeds of *S. aspera* have prominent ornamentation of the secondary ridges (fig. 14) where the protuberances are larger than those on the primary rigdes, as in some strains of *S. hermonthica* (fig. 17). Surface features of *S. passargei* (fig. 13) are not sufficiently distinct to separate it from *S. aspera* or *S. hermonthica*.

Neither surface features of *S. densiflora* (a very distinct species in its morphology (fig. 2), nor of the ill defined Australian species *S. parviflora* (fig. 18) are sufficient to separate them from other species. The seeds are, in fact, indistinguishable from *S. asiatica*.

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